efforts can make full use of that experience, and pose no threat to the remaining wild birds whose conservation remains the highest priority. The gaps in current knowledge were highlighted, and criteria developed for site selection, release methods, the source of birds for release, post-release procedures and success criteria. The following summary was prepared.

Workshop Communiqué

1. An analysis of the current status of the critically endangered wild population of Waldrapp was undertaken. It was concluded that the unique Souss–Massa population is currently stable but is not increasing.
2. As a priority it was agreed that the 1997 action plan for the conservation of Waldrapp in the Souss–Massa region is regularly updated and implemented.
3. The possibility of supplementing the Souss–Massa population was considered and rejected, for the time being, as the risks were considered unacceptable.
4. The only chance to increase the number and range of Waldrapp in a significant manner is by reintroduction. It was recommended that the purpose of any reintroduction programme should be to create additional, self-sustaining wild populations, thereby removing it from the IUCN critically endangered list. It was noted that, as there is no urgency for reintroduction, and in view of the fact that a detailed and tested release method has not yet been identified, caution is urged. However, it is urgent to intensify research on release methods and to test them to gain sufficient experience.
5. It was recognised that there are two distinctive populations, an eastern and a western form and that their respective ranges should be respected. In view of the highly successful captive-managed western population, sufficient birds can be made available for potential programmes over the next 10–20 years.
6. On the basis of the IUCN/SSC Reintroduction Specialist Group (RSG) recommendations, the workshop developed specific guidelines for Waldrapp. The latter must be regularly updated in the light of experience and followed by any programmes involving release/ reintroduction.
7. In order to ensure international co-ordination and co-operation, it was decided to create the International Advisory Group for Bald Ibis (IGANBI) with the following Terms of Reference:

- receive propositions for all Waldrapp release/re-introduction projects.
- review propositions according to the IUCN and workshop guidelines, and a potential Bald Ibis Action Plan. The group will seek advice from other experts if appropriate (only advice, not permits).
- ensure information exchange/information centre (+ annual newsletter, web site).
- advise if required.
- submit proposal to IUCN (RSG).
- encourage adapted scientific research to close gaps.

The workshop gave the opportunity for the presentation of previously unpublished material on the causes of extinction from former sites, on the problems of long-distance erratic movements of released birds, of veterinary and behavioural considerations for the wild population, and the genetic and stock considerations of the birds proposed for release. Two proposed methodologies were presented and critically assessed, a 'hand-rearing method' and an 'aviary release'.

Copies of the 50-page report are available by e-mail from: Chris.Bowden@rspb.org.uk.

Royal Society for the Protection of Birds, The Lodge, Sandy, Beds. SG19 2DL, UK.

Brief report on a pilot study on the effects of forest fragmentation: interactions between seed dispersers and trees whose seeds are dispersed by animals

N. J. Cordeiro

In June 1998, I was able to undertake a preliminary examination of the impact that forest fragmentation may have on the recruitment of animal-dispersed trees. This study was performed in the East Usambaras, Tanzania, where many fragments are separated from continuous forest in the plateau region around Amani. The bulk have been isolated for at least 80 years by tea plantations, as well as by cultivation[3,6]. Newmark[6] demonstrated that fragmentation has led to reduced diversity of understorey forest birds in this area.

which served as a basis for this pilot study. A major objective was to evaluate whether losses of frugivorous animals, due to forest fragmentation, leads to reduced recruitment of seedlings and juveniles of animal-dispersed tree species.

Due to isolation and associated factors, eg reduction of available habitat, it was predicted that some animal-dispersers have probably succumbed to local extinction in small, more isolated, fragments. In contrast, larger fragments and continuous forest probably have more intact frugivore assemblages. Loss or reduced densities of dispersal agents in tropical sites are predicted to have an enormous negative impact on the recruitment of dispersal-dependent tree species[2,4]; however, few studies have adequately addressed this issue, especially in Africa. Outcomes of local extinctions of dispersal vectors, or minimal dispersal of seeds by fewer individuals in small fragments, could ultimately lead to graveyards where many adults survive while seedlings and juveniles suffer high mortality due to density-dependent effects[4]. Larger fragments and continuous forest appear healthier due to the presence of more intact frugivore assemblages.

I conducted vegetational transects, with the assistance of A Mndolwa (Amani Botanical Garden botanist), in different sized fragments (two <10, one 30, and one 520 ha), and continuous forest (c4,000 ha of submontane forest). Trees were enumerated in several size classes, from seedling (dbh <1 cm) to adult stages (dbh >50 cm). Tree species were divided into non-animal- and animal-dispersal categories based on observations of diaspores, a literature review and consultation with botanical experts (e.g. J Lovett).

For animal-dispersed trees, juveniles are proportionately fewer than adults in smaller fragments (<10 ha), whereas the reverse is true at larger sites (>30 ha). If non-animal-dispersed species exhibited similar patterns to animal-dispersed species, this would indicate that abiotic factors introduced by fragmentation may explain these results. This was not true, and non-animal-dispersed trees generally had more juveniles in proportion to adults at all sites, indicating 'healthy' recruitment irrespective of fragmentation. To further support this, comparing seedling and juvenile densities of both dispersal categories across sites was essential. These data also indicated that recruitment decreased as a function of decreasing fragment size for animal-dispersed trees, whereas non-animal-dispersed trees showed the opposite trend.

Although the loss of dispersal agents could explain these patterns, other biotic effects such as enhanced seed predation in the smaller fragments could also have increased mortality of seedlings and juveniles of animal-dispersed trees. At present, it appears that biotic effects from fragmentation are impacting the fate of animal-dispersed trees. However, a more in-depth study will be undertaken in the near future, with particular emphasis on obligate bird and primate frugivores, which are believed to be more vulnerable to fragmentation[1,5]. Furthermore, additional sites will be covered and the dispersal effectiveness of different agents will be evaluated for focal tree species across sites. Lastly, an outcome of the ensuing project is a planned collaboration with the Wildlife Conservation Society of Tanzania (through M Msuha) to conduct field training workshops for students interested in animal-plant interactions and conservation.

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References

1. Bennun, L. and Fanshawe, J. 1998. Using forest birds to evaluate forest management: an East African perspective. In Doolan, S. (ed) *African rainforests and the conservation of biodiversity*. Limbe: Earthwatch Europe.
2. Chapman, C.A. and Chapman, L.J. 1995. Survival without dispersers: seedling recruitment under parents. *Conserv. Biol.* 9: 675–678.
3. Hamilton, A.C. and Bensted-Smith, R. (eds) 1989. *Forest Conservation in the East Usambara Mountains, Tanzania*. Gland & Cambridge, UK: International Union for the Conservation of Nature.
4. Howe, H. F. 1984. Implications of seed dispersal by animals for tropical reserve management. *Biol. Conserv.* 30: 261–281.
5. Laurance, W.F. and Bierregaard, R.O. (eds) 1997. *Tropical forest remnants*. Chicago: University of Chicago Press.
6. Newmark, W.D. 1991. Tropical forest fragmentation and the local extinction of understory birds in the East Usambara Mountains, Tanzania. *Conserv. Biol.* 5: 67–78.

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